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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant : Simon C. Steely, Jr., et al.

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For : SYSTEM AND METHOD FOR CONFLICT
RESPONSES IN A CACHE COHERENCY
PROTOCOL WITH ORDERING POINT
MIGRATION

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REPLY BRIEF

Sir:

This Reply Brief is in response to the Examiner's Answer dated March 13, 2008. This Reply Brief addresses the Examiner's Answer concerning the appealed claims 1-40.

I. **Appealed Claim 1**

In the Examiner's Answer dated March 13, 2008 ("Examiner's Answer"), it is contended that the modifying transaction 150a disclosed in U.S. Patent Pub. No. 2002/0129211 to Arimilli, et al. ("Arimilli") corresponds to a source broadcast request, as recited in claim 1 (See Examiner's Answer, Page 29). For reasons already presented on pages 22-25 of the Appeal Brief filed December 5, 2007 ("Appeal Brief"), Appellant's representative respectfully submits that no structure or process disclosed in Arimilli reads on a first node that provides a source broadcast request for data, as recited in claim 1.

Additionally, in the Appeal Brief, Appellant's representative argued that Arimilli fails to disclose a first node being operable to respond in a second manner to other source broadcast requests for data in response to receiving an ownership data response at the first node, the ownership data response comprising a copy of the data, as recited in claim 1. In response, the following was stated in the Examiner's Answer:

Arimilli also discloses "the first node being operable to respond in a second manner to other source broadcasts for the data in response to receiving an ownership data response" as ["master 26 (an agent that has received ownership) prevents access to the target cache line by other agents 10 by means of appropriate snoop responses (which comprises a second manner of responding as claimed) until the store into the cache array 24 is completed" (Page 4, Par. 0036), wherein only the agent that owns a cache line can modify it... See Examiner's Answer, Page 31.

Appellant's representative respectfully submits that the above statement illustrates that claim 1 has been misconstrued. In referring to the cited sections of Arimilli, the Examiner's Answer fails to articulate what structure or process corresponds to the ownership data response recited in claim 1. Instead, the Examiner's Answer highlights a portion of Arimilli that discusses a specific situation where the master 26 already has received ownership of a target cache line (e.g., Modified (M) state or Exclusive (E) state of a MESI protocol). However, Appellant's representative respectfully submits that nothing in Arimilli discloses (or even suggests) that receiving ownership of a cache line reads on the ownership data response recited in claim 1, since the ownership data response recited in claim 1 comprises a copy of requested data, while in Arimilli, receiving ownership of a cache

line would only indicate that the agent receiving the ownership is allowed to modify the associated cache line (See e.g., Arimilli, Par. [0036]). Appellant's representative respectfully submits that no structure or process disclosed in Arimilli reads on the ownership data response recited in claim 1. Consequently, Arimilli fails to disclose the first node being operable to respond in a second manner to other source broadcast requests for data in response to receiving an ownership data response at the first node, the ownership data response comprising a copy of the data, as recited in claim 1.

In an effort to make up for the deficiencies of Par. [0036] of Arimilli, the Examiner's Answer states:

Appellant argues [that] Arimilli does not disclose [an] ownership data response because ownership is granted to already cached data; however the Examiner would like to respectfully point out that this limitation is not being claimed as the claimed broadly requires "ownership data response" which is taught by Arimilli as the coherency decision point (CDP) which "is the snooper or the agent 10 that holds the data of the target cache line in the highest state of ownership" and explains "the CDP grants (which clearly comprises an ownership data response) ownership of the target cache line to other agents 10 by providing appropriate snoop responses to the transactions during the snoop response periods" (Pars. [0030]-[0032]). See Examiner's Answer, Page 32.

Once again, Appellant's representative respectfully submits that the Examiner's answer has not identified any structure that correspond to the ownership data response recited in claim 1, since the ownership data response recited in claim 1 comprises a copy of the data, while nothing in Arimilli discloses that the granting of ownership by the CDP would comprise a copy of the requested data.

In yet another attempt to overcome the aforementioned deficiencies of Arimilli, the Examiner's Answer states:

Arimilli clearly discloses "a first node receiving an ownership data response comprising a copy of the data" as ["The one or more shared cache coherency states may optionally include a shared-owner state that designates a single owner of a potentially shared cache line" (Page 2, Par. [0024]) and explains that "master 26 of a first agent, for example, processor complex 10a issues a modifying transaction 150a (i.e., Dclain or RWITM) (Page 3, Par. [0029]) wherein this processor is granted ownership of the cache line and is designated as OWNER or OWNER_CU (See Table III in Page 6), wherein "The RWITM transaction requests that the initiating

agent be provided an up-to-date copy (which is clearly a copy of the data) of a target cache line and that other agents invalidate their copies of the cache line, if any (Page 1, Par. [0006]) wherein "FIG. 3B, which illustrates master 26 issuing a RWITM transaction on the system bus 12 to obtain a copy (wherein owner obtains a copy of data as claimed) of the cache line from another agent 10 for modification" (Par. [0035]) wherein a master issues a "RWITM" transaction for data and data is transferred from an agent that has previously modified a cache line to the agent that intends to modify this cache line in order to provide this agent requesting ownership [of] the most-current data in the system, the master is issuing an ownership response request comprising a copy of the data as claimed by Applicant]. See Examiners Answer, Pages 32-33.

Appellant's representative respectfully submits that the Examiner's Answer demonstrates that Arimilli fails to disclose an ownership data response, as recited in claim 1. The Examiner's Answer appears to contend that Arimilli discloses a master 26 that issues a read with intent to modify (RWITM) transaction and subsequently receives the requested data and ownership of the data, thus reading on the ownership data response recited in claim 1. Appellant's representative respectfully disagrees. Nowhere in any of the cited sections of Arimilli (or Arimilli generally) does Arimilli disclose a first node (which the Examiner's Action appears to contend corresponds the master 26) receiving an ownership data response comprising a copy of data, as recited in claim 1 (emphasis added). Instead, the Arimilli merely discloses that the master 26 issues a request for data (the RWITM).

Moreover, the Examiner's Answer also states:

[E]xaminer would like to point out that functional recitations of "the first node being [capable of or] operative to respond in a first manner and that the first node being [capable of or] operative to respond in a second manner do not make the claimed invention patentably distinct over the prior art of record. While features of a system may be recited either structurally or functionally, claims directed to a system must be distinguished from the prior art in terms of structure rather than function...

...claim 1 recites, inter alia, "the first node being operative to respond in a first manner... the first node being operative to respond in a second manner." While the limitations require "a first node," the functional recitations: "respond in a first manner" and "respond in a second manner" do not distinguish the claims from the prior art. See Examiner's Answer, Pages 33-34.

Appellant's representative respectfully submits that the above statement demonstrates that claim 1 has not been given adequate patentable weight.

Functional terminology covers any and all embodiments which perform the recited function. *In re Swinehart*, 439 F.2d 210, 213, 169 U.S.P.Q. 226 (C.C.P.A. 1971). In claim 1, the first node is operable to respond in a first manner to other source broadcast requests for the data while the source broadcast request for the data is pending at the first node and the first node is operable to respond in a second manner to the other source broadcast requests for the data in response to receiving an ownership data response at the first node. Thus, claim 1 recites specific operability of the first node in how it responds in distinct first and second manners in contrast and beyond any teachings in *Arimilli*. Appellant's representative respectfully submits that claim 1 could only be anticipated if *Arimilli* teaches, explicitly or inherently, a first node that is configured (e.g., programmed via hardware, software or a combination thereof) to perform in the same manner as the first node recited in claim 1 (specifically including responding in the recited first and second manners). Appellant's representative respectfully submits that, due to the absence of such a showing, claim 1 has not been anticipated, regardless of whether claim 1 is considered to be drafted in structural terms, functional terms, or a combination thereof.

For the reasons stated above, as well as the reasons given in the Appeal Brief, Appellant's representative respectfully submits that *Arimilli* does not anticipate claim 1. Accordingly, Appellant's representative respectfully requests that the rejection of claim 1 be withdrawn, and that claim 1 be passed to issue.

II. Appealed Claim 3

On pages 28-30 of the Appeal Brief, Appellant's representative set forth reasons that a cache ordering point migrating to a first node from a node that provides an ownership data response, as recited in claim 3, is not disclosed by *Arimilli*. The Examiner's Answer responded as follows:

[T]he coherency decision point (CDP) (which corresponds to the claimed cache ordering point) which "is the snooper of the agent 10 that holds the data of the target cache line in the highest state of ownership" and explains "the CDP grants (which clearly comprises an ownership data response) ownership of the target cache line to other agents 10 by providing appropriate snoop responses to the transactions during the snoop response periods" wherein "the combined response informs an agent 10 that issued a transaction

whether or not it "won" the arbitration performed by the CDP and is the new owner of the target cache line (and also the new CDP in the preferred embodiment)" (Pars. [0030]-[0032]) wherein in Arimilli, the new owner becomes the new CDP or cache ordering point thereby migrating a cache ordering point to the new owner as claimed. See Examiner's Answer, Page 35.

Appellant's representative respectfully submits that the entire argument offered by the Examiner's Answer rests on a faulty premise that a coherency decision point (CDP) reads on the cache ordering point recited in claim 3. Appellant's representative respectfully disagrees with this interpretation of Arimilli. In Arimilli, the CDP is defined as the device that grants or denies ownership of a target cache line that is held in a shared state for purposes of modification (See Arimilli, Par. [0030]). In claim 3, the ordering point itself migrates to a first node from a node that provides an ownership data response. Thus, in claim 3, the node that provides the ownership data response is the ordering point for the data before the ordering point migration. By virtue of claim 3's dependence from claim 1, the ownership data response comprises a copy of data. Appellant's representative respectfully submits that granting of ownership (performed by the CDP disclosed in Arimilli) does not correspond to a copy of data, as recited in claim 3 (by virtue of claim 3's dependence from claim 1) as the CDP does not migrate nor does it cause migration of an ordering point. Since Arimilli fails to disclose that the CDP provides an ownership data response, the CDP cannot correspond to the node that provides an ownership data response recited in claim 3. Thus, Arimilli cannot disclose a cache ordering point migrating to a first node from a node that provides the ownership data response, as recited in claim 3.

In an attempt to support the above argument, the Examiner's Answer also argues:

"[M]aster 26 issuing a RWITM transaction on [a] system bus 12 to obtain a copy of the cache line from another agent 10 for modification" (Page 4, Par. [0035]); therefore, as the copy of the valid data is transferred to the owning processor thereby, the owner processor becoming the ordering point, as claimed. See Examiner's Answer, Pages 35-36.

As discussed above, the Examiner's Answer appears to contend that a master 26 that issues RWITM transaction and subsequently data is transferred to the master

26 that issued the RWITM transaction. Appellant's representative respectfully disagrees with the line of reasoning that relies on the RWITM transaction in Arimilli. Nowhere in any of the cited sections of Arimilli (or Arimilli generally) does Arimilli disclose a transferring data to a first node (which the Examiner's Action appears to contend correspond the master 26) in response to a RWITM transaction. Instead, Arimilli merely discloses that the master 26 issues a request for data (the RWITM), but fails to expand beyond mentioning that the RWITM transaction is issued. Regardless of whether a response is provided to the RWTIM issued by the Master 26, Arimilli is silent on how the master 26 might function or respond to requests while the RWITM is pending. Specifically, there is no evidence in Arimilli or in the Examiner's Answer to support that the master would respond in a first manner to other source broadcast requests for the data while the RWITM transaction is pending at the master and in a second manner to the other source broadcast requests for the data in response to receiving an ownership data response at the first node, as recited in claim 1 from which claim 3 depends. Consequently, Arimilli cannot disclose a cache ordering point migrating to a first node from a node that provides the ownership data response, as recited in claim 3.

For the reasons stated above, as well as the reasons given in the Appeal Brief, Appellant's representative respectfully submits that Arimilli does not anticipate claim 3. Accordingly, Appellant's representative respectfully requests that the rejection of claim 3 be withdrawn, and that claim 3 be passed to issue.

III. Appealed Claim 5

On pages 30-31 of the Appeal Brief, Appellant's representative set forth reasons that a first node, when responding in a first manner, provides a first response to other source broadcast requests for data indicating that the first node has a conflicting read request for the data, as recited in claim 5, is not disclosed by Arimilli. Thus, Appellant's representative respectfully submits that the rejection to claim 5 be withdrawn, and that claim 5 be passed to issue.

IV. Appealed Claim 6

On pages 31-33 of the Appeal Brief, Appellant's representative set forth reasons that a second node that provides one of an other source broadcast request for data and receives a first response from a first node, the second node being operative to fill a shared copy of data received from a third node in response to the one of the other source broadcast requests for the data, as recited in claim 6 is not disclosed in Arimilli. The Examiner's Answer responded as follows:

"The RWITM (which corresponds to a source broadcast request for data as claimed) transaction requests that the initiating agent be provided an up-to-date copy (wherein providing an up-to-date copy from one agent to another corresponds to filling a shared copy of data from one node to another as claimed) of a target cache line and that other agents invalidate their copies of the cache line, if any" (Page 1, Par. [0006]) wherein "FIG. 3B, which illustrates master 26 issuing a RWITM transaction on a system bus to obtain a copy... of the cache line from another agent 10 for modification" (Par. [0035]). See Examiner's Answer, Page 38-39.

Appellant's representative respectfully submits that the above statement made in the Examiner's Answer does not identify what structure or process of Arimilli would correspond to the second node recited in claim 6. Moreover, in rejecting claim 1, from which claim 6 depends, the Examiner's Answer contends that a RETRY_notCDP SR response disclosed in Arimilli corresponds to a first node's first manner of response (See Examiner's Answer, Page 30). The Examiner's Answer fails to even attempt to show that any action is taken by any node (including the second node recited in claim 6) that receives a RETRY_notCDP SR response. This is because Arimilli fails to describe what action might be performed by a node that receives such response. For instance, Table I at page 5 of Arimilli discloses that the RETRY_notCDP SR response can be provided in response to a Dclaim or RWITM transaction to indicate that the responding agent has a pending store request that conflicts with the snooped transaction (Dclaim or RWITM) and the agent is not the CDP. However, there is no evidence in Arimilli or elsewhere in the Examiner's Answer to support that such RETRY_notCDP SR response, if a first manner of response as described in the Examiner's Answer, would cause the second node to be operative to fill a shared copy of data received from a third node in response to the one of the other source broadcast requests for the data. Thus, Appellant's

representative respectfully submits that the Examiner's Answer fails to show that Arimilli anticipates claim 6.

Moreover, in the Examiner's Answer, it is once again argued that functional recitations of claim 6 should not be given patentable weight (See Examiner's Answer, Page 39). As discussed above with respect to claim 1, functional elements of claim 6 can distinguish claim 6 from the prior art. *In re Swinehart, supra*. Therefore, the Examiner's Answer has erred by failing to give adequate patentable weight to all of the features in claim 6. Thus, for the reasons discussed above, along with the reasons given in the Appeal Brief, Appellant's representative respectfully submits that the rejection to claim 6 be withdrawn, and that claim 6 be passed to issue.

V. Appealed Claim 8

On pages 33-34 of the Appeal Brief, Appellant's representative set forth reasons that a first node, when responding in a second manner, provides a second response to other source broadcast requests for the data indicating that the source broadcast request from the first node is a conflicting request for the data and that migration of the data to the first node is in progress, as recited in claim 8 is not disclosed in Arimilli. The Examiner's Answer responded as follows:

"FIG. 3b, which illustrates a master 26 issuing a RWITM transaction on system bus 12 to obtain a copy... of the cache line from another agent 10 for modification" (Par. [0035]); (wherein it is clear to one of ordinary skill in the art that these snoop responses indication migration of data as claimed). See Examiner's Answer, Page 42.

Appellant's representative respectfully submits that the arguments offered in the Examiner's Answer illustrate a misplaced reliance on Arimilli's disclosed RWITM transaction or at least a misinterpretation of what is disclosed in Arimilli. As discussed above with respect to claim 3, Arimilli fails to disclose transferring data to a first node (which the Examiner's Answer appears to contend corresponds to the master 26) in response to a RWITM transaction. Instead, Arimilli merely discloses that the master 26 issues a request for data (the RWITM) without any further teaching of how the master might respond to other requests. Thus, for the reasons discussed herein with respect to claim 3, Arimilli cannot disclose a cache ordering point migrating to a first node from a node that provides the ownership data

response, as recited in claim 8. Therefore, the RWITM transaction does not indicate a migration of data within the combination of features of claim 8, as contended in the Examiner's Answer. Consequently, for the reasons discussed above, along with the reasons given in the Appeal Brief, Appellant's representative respectfully requests that the rejection to claim 8 be withdrawn, and that claim 8 be passed to issue.

V. Appealed Claim 9

On pages 34-35 of the Appeal Brief, Appellant's representative set forth reasons that claim 9 is not disclosed by Arimilli. The Examiner's Answer repeated arguments offered in the Final Office Action ("Final Action") issued on March 29, 2007, as well as arguing that functional elements recited in claim 9 cannot distinguish claim 9 from the prior art. Thus, for reasons discussed in the Appeal Brief, as well as those discussed above with respect to claim 1, functional features of a claim can distinguish the claim from the prior art. Therefore, the Examiner's Answer has erred by failing to give adequate patentable weight to all of the features in claim 9. Thus, for the reasons discussed above, along with the reasons given in the Appeal Brief, Appellant's representative respectfully requests that the rejection to claim 9 be withdrawn, and that claim 9 be passed to issue.

VI. Appealed Claim 16

In the Examiner's Answer, the Examiner offers similar arguments to support the rejection of claim 16 that were used to support the rejection of claim 1 and 3 (See Examiner's Answer, Pages 44-46). Thus, Appellant's representative respectfully submits that the Final Action and the Examiner's Answer fail to establish that Arimilli anticipates claim 16 for reasons similar to those discussed herein above with respect to claims 1 and 3 and for reasons discussed in the Appeal Brief.

In particular, the Examiner's Answer improperly relies on the view that Arimilli discloses that data is provided to a master 26 (which the Examiner's Answer contends corresponds to a source processor recited in claim 6) in response to RWITM transaction (See Examiner's Answer, Page 45). However, nowhere in Arimilli is this concept disclosed. Instead, Arimilli merely discloses that a RWITM transaction is issued, without mentioning how the master would respond, especially not consistent with the combination of structural and functional features recited in

claim 16. Thus, Appellant's representative respectfully requests that the rejection of claim 16 be withdrawn and that claim 16 be passed to issue.

VII. Appealed Claims 10, 23, 30 and 38

On pages 57-59 of the Appeal Brief, Appellant's representative argued Arimilli taken in view of 6,138,218 to Arimilli, et al. ("Arimilli 2") does not make claims 10, 23, 30 and 38 obvious. In response, the Examiner's Answer once again argues that functional elements of claims do not make a claimed invention patentable over the prior art. As discussed with respect to claim 1, such a statement illustrates that the Examiner's Answer has erred by failing to give adequate patentable weight to the functional features of claims 10, 23, 30 and 38.

Additionally, in the Appeal Brief, Appellant's representative argued that Arimilli and Arimilli 2 taught away from their combination and modification in a manner suggested in the Final Action. In response, the Examiner's Answer stated the following:

The Examiner would also like to point out that the reference to Arimilli does not teach away from combining Arimilli with Arimilli 2 to obtain the claimed invention as Arimilli's disclosure does not criticize, discredit, or otherwise discourage the solution claimed. *In re Fulton*, 391 F.3d 1195, 1201, 73 U.S.P.Q.2d 1141, 1146 (Fed. Cir. 2004). See Examiner's Answer, Page 42.

Appellant's representative respectfully submits that the arguments given in the Examiner's Answer illustrate that the Appellant's arguments regarding the patentability of claims 10, 23, 30 and 38 were not fully considered. While Appellant's representative acknowledges that two references teach away from their combination and modification when one reference discredits the teachings of another reference (such as the issue in *In re Fulton*, as cited by the Examiner's Answer), two references can also teach away from their combination and modification when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant... [or] if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. *Air, Inc. v. Denso Mfg. Mich., Inc.* 192 F.3d 1353, 1360, 52 U.S.P.Q.2d 1294 (Fed. Cir. 1990).

Appellant's representative respectfully submits that the arguments offered in the Appeal Brief with regard to claims 10, 23, 30 and 38 are based on the premise that Arimilli teaches a direction divergent from the approach of claims 10, 23, 30 and 38. Thus, the Examiner's arguments that Arimilli does not teach away from its combination and modification with Arimilli 2 because Arimilli does not "criticize, discredit, or otherwise discourage the solution claimed" fail to lend credence to the anticipation rejection in view of Appellant's arguments presented in its Appeal Brief. Accordingly, for the reasons stated above, as well as those stated in the Appeal Brief, Arimilli taken in view of Arimilli 2 does not make claims 10, 23, 30 and 38 obvious. Consequently, Appellant's representative respectfully requests that the rejection of claims 10, 23, 30 and 38 be withdrawn, and that claims 10, 23, 30 and 38 be passed to issue.

VIII. Appealed Claims 11 and 24

On page 59 of the Appeal Brief, Appellant's representative argued that Arimilli taken in view of Arimilli 2 does not make claims 11 and 24 obvious. In particular, Appellant's representative argued that in contrast to the contentions made in the Final Action, Arimilli 2 failed to teach or suggest a forward progress protocol, as recited in claims 11 and 12. In response, the Examiner's Answer stated the following:

[W]herein Arimilli 2 discloses using R-MESI wherein "the MESI protocol... the protocol state, which is indicated by bits in the cache directory" (Col. 1, Lines 33-40). See Examiner's Answer, Page 54.

Thus, it appears that the Examiner's Answer contends that the R-MESI protocol disclosed in Arimilli 2 corresponds to the forward progress protocol recited in claims 11 and 24. Appellant's representative respectfully disagrees. In Arimilli 2, the R-MESI protocol is the MESI protocol with a recent (R) state that is a variant of the shared (S) state indicating that the cache entry may be found in both the subject cache and at least one other cache at the same level in the storage hierarchy (See Arimilli 2, Col. 1, Lines 64-67). However, the Examiner's Answer fails to explain how the R-MESI protocol corresponds to the forward progress protocol, as recited in claims 11 and 24. Thus, Appellant's representative maintains that Arimilli 2 fails to teach or suggest a forward progress protocol, as recited in claims 11 and 24.

Accordingly, for the reasons stated above, as well as the reasons given in the Appeal Brief, Appellant's representative respectfully requests that the rejection of claims 11 and 24 be withdrawn, and that claims 11 and 24 be passed to issue.

IX. Appealed Claim 15

On pages 60-62 of the Appeal Brief, Appellant's representative argued Arimilli taken in view of Arimilli 2 and in further view of U.S. Patent No. 6,883,070 to Martin et al. ("Martin") does not make claim 15 obvious. Appellant's representative respectfully submits that the Examiner's Answer regarding the rejection of claim 15 is similar to the rejection of claims 10, 23, 30 and 38, as well as claims 11 and 24. Thus, Appellant's representative respectfully submits that claim 15 is not made obvious by Arimilli taken in view of Arimilli 2 and in further view of Martin for reasons similar to those discussed above with respect to claims 10, 23, 30 and 38, as well as claims 11 and 24.

In particular, none of the cited art (including Arimilli 2) teaches or suggests employment of a forward progress protocol, as recited in claim 15. Additionally, the Examiner's Answer has not given proper consideration to Appellant's representative's arguments regarding the motivation to combine and modify the teachings of Arimilli and Arimilli 2. Accordingly, for the reasons stated above, as well as the reasons given in the Appeal Brief, Appellant's representative respectfully requests that the rejection of claim 15 be withdrawn, and that claim 15 be passed to issue.

CONCLUSION

In view of the foregoing remarks, Appellant's representative respectfully submits that the present application is in condition for allowance. Appellant's representative respectfully requests reconsideration of this application and that the application be passed to issue.

No additional fees should be due for this Reply Brief. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 08-2025.

I hereby certify that this correspondence is being transmitted to the U.S. Patent and Trademark Office via electronic filing on April 30, 2008.

Respectfully submitted,

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